# Technical and Commercial Losses Reduction in Surat Urban Division of GEB

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# Abbreviations

| | |
|---|---|
| APDP | Accelerated Power Development Programme |
| CT | Current Transformer |
| DG | Diesel Generator |
| GEB | Gujarat Electricity Board |
| GEF | Global Environmental Facility |
| GERC | Gujarat Electricity Regulatory Commission |
| GOG | Government of Gujarat |
| HR | Human Resource |
| HT | High Tension |
| LT | Low Tension |
| MOP | Ministry of Power |
| MU | Million Unit |
| MW | megawatt |
| NGO | Non Governmental Organization |
| TERI | Tata Energy Research Institute |
| UNDP | United Nation Development Programme |

# Medium-sized Project Brief

## PROJECT SUMMARY

**PROJECT IDENTIFIERS**

| | |
|---|---|
| 1. **Project name:**<br>Reduction in technical and commercial losses in the distribution system of Surat Urban Division | 2. **GEF Implementing Agency:**<br>United Nations Development Programme |
| 3. **Country or countries in which the**<br>4. **project is being implemented:**<br>India | 1. **Country eligibility:**<br>India's commitment for finding lasting solutions to global environmental issues is evident from its ratification of the Framework Convention on Climate Change on 01 November 1993.<br>It is a Non-Annex-I developing country with its economy undergoing rapid growth spurred by recent policy changes to reflect its global concerns.<br>India has been a recipient of loans from the World Bank/IMF as well as other monetary grants and technical assistance from UNDP in the past. |
| 2. **GEF focal area(s):**<br>Climate Change | 6. **Operational programme/Short-term measure:**<br>**Under operational programme no. 5**; Removal of barriers to energy efficiency in a distribution system by applying appropriate technical solutions and managerial instruments |

7. **Project linkage to national priorities, action plans, and programmes:**

- Energy conservation, protection of environment and the revamping of power sector have been foremost among the government priorities. Government of India has initiated numerous activities in this priority area. Under this, Ministry of Power initiating APDP (accelerated power development programme) programmes and various notifications in the area of environment provide ample testimony to this.
- Reforms process have been initiated by the central/state government to make the power sector financially viable and to reduce the level of mounting losses.

Unbundling, corporatisation and privatization have characterized the power sector

In the last few years.

- Government of India has started the APDP programme in each State to revamp the distribution system in order to improve the quality of power supplied and to bring down the losses to the internationally accepted level.
- The proposed project has excellent compatibility with the national priorities. The global perspective of this project is climate stabilization by reducing the losses in distribution system. The proposed project, which aims to reduce technical and commercial losses in the distribution system, has a bearing on the global environment also. Reduction in technical and commercial losses will demand generation. Thus it will reduce the fuel requirement and consequently $CO_2$ emissions to the atmosphere.

**8. GEF national operational focal point and date of country endorsement:**
"Ministry of Environment and Forests"; *November 1993*.

**PROJECT OBJECTIVES AND ACTIVITIES**

| | |
|---|---|
| **9. Project rationale and objectives:** | **Indicators:** |
| • Reduction in technical and commercial losses in the distribution system of Surat Urban Division<br>• System improvements to reduce technical losses<br>• Design a managerial framework for reducing commercial losses | • Increase in revenue collection<br>• Energy audit<br>• Improved quality of supply<br>• Improved voltage<br>• Reduction in current<br>• Vigilance squads<br>• Metering arrangements<br>• Computerization of billing systems |
| **10. Project outcomes:** | **Indicators:** |
| • Reduction in technical losses through system changes.<br>• Reduction in commercial losses.<br>• Increase in revenue realization<br>• Better metering arrangements<br>• Better billing system<br>• Trained manpower | • Increase in number of substations/ transformers<br>• Changes in HT and LT length of feeders<br>• Change in type of conductor<br>• Changes in energy sent and billed<br>• Divisional records<br>• Timely delivery of accurate and computerized bills<br>• Availability of trained manpower |
| **11. Project activities to achieve outcomes (including cost in US$ or local currency of each activity):** | **Indicators:** |
| • Data collection feeder-wise: load data, system parameters, log sheet details, single line diagrams etc<br>• System simulation | • Official record,<br>• Increased number of feeders,<br>• Increased number of substation<br>• Physical verification of network<br>• Physical verification of meter installation |

| | |
|---|---|
| • Feeder-wise load forecast<br>• System simulation and result analysis<br>• Identification of options<br>• Expansion of network<br>• Bifurcation/reconductoring of feeders and redistribution of loads<br>• Creation of new substations<br>• Installation of digital meters with memory banks<br>• Computerized billing<br>• Setting up of a managerial system including vigilance squads<br>• Training of manpower. | • Physical verification of billing system and electricity bills<br>• Information in record of utility |

12. Estimated budget (in US$ or local currency):[1]

| | US$ (Million) |
|---|---|
| PDF: | 0.063 |
| GEF: | 13.62 |
| Co-financing: | 0.625 |
| TOTAL: | 14.311 |

## INFORMATION ON INSTITUTION SUBMITTING PROJECT BRIEF

### 13. Information on project proposer:

The Gujarat Electricity Board (GEB) came into existence in the year 1960 with the formation of the state of Gujarat. GEB is engaged in generation, transmission, and distribution of electricity in the State. Within a span of 40 years, GEB has contributed substantially in providing critical parameters for the industrial growth of the state and in improving the living standard of the people of the state. As on March 2001 GEB has an installed capacity of 8267 MW contributed by different fuel sources. In GEB present per capita consumption is 932 units compared to 48 units at the time of its inception.

The Transmission Department carries out construction, operation and maintenance of the 400KV, 220KV, 132KV and 66KV EHV network comprising transmission lines and sub-stations. For discharging the above work, total eight transmission circles have been established. Power is distributed to consumers by HT feeders of voltage level at 22 and 11 kV.

In Surat circle electricity is distributed to end use consumers through HT and LT network. The Surat circle is divided into 26 sub-divisional offices each headed by a Deputy Engineer. The deputy engineers are responsible for providing power supply to consumers and other consumer services like handling their grievances, if any. They are also in charge of erecting and maintaining the network in their area of jurisdiction.

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[1] Conversion rate 1US Dollar = 48 Indian Rupees

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| **14. Information on proposed executing agency (if different from above):**<br>Ministry of Power and Gujarat Electricity Board |
| **15. Date of initial submission of project concept:** 7th February,2001 |
| INFORMATION TO BE COMPLETED BY IMPLEMENTING AGENCY: |
| 16. Project identification number: |
| 17. Implementing Agency contact person: |
| 18. Project linkage to Implementing Agency programme(s): |

## Project Description

### *PROJECT RATIONALE AND OBJECTIVES*

The project explores the options by which the global objective of climate stabilization can be achieved. In the process of thermal generation from various fuel sources, unwanted and polluting substances are emitted into the atmosphere. Therefore any option that results in reduction of the generation requirement is consistent with the objective of reducing CO2. In an Electricity System, a reduction in distribution losses will result in a corresponding reduction of generation requirement, thereby helping to fulfil the global objective. In this project various options for distribution loss reduction have been explored and analyzed, and the outcomes have been compared against the cost of carbon reduction.

Currently, the losses in the distribution system of Surat Urban Division are very high i.e. more then 40% of the total energy sent. This is mainly due to financial and manpower constraints, emergency need for expansion of network and haphazard manner of building construction, which leads to improper expansion of network and poor management activities. The aim of this project is to reduce the technical and commercial losses in an urban division of Surat in Gujarat by applying appropriate technical solutions and managerial instruments. This project aims to bring down the technical losses through system changes such erection of new feeders and substations, bifurcation of existing feeder etc. The other specific objective of this project is to reduce the commercial losses. This will not only increase the revenue but will also contribute to lower electricity consumption. This can be achieved by setting up a proper managerial system in place. This project aims to achieve this through changes in the administrative system at the divisional level such as setting up an H R Cell and vigilance squads at divisional level, better metering arrangements and billing systems in order to curb the theft and tampering of meters.

The project will be a model for replication in the entire state of Gujarat and/or India. If implemented it will have greater domestic benefits such as less generation, increased revenue realization, less fuel consumption and hence less emission of $CO_2$ to the atmosphere.

### *CURRENT SITUATION*

The focal area of this project is Surat, which is located in the southern part of Gujarat. The Gujarat electricity system is divided into five zones, 19 circles, 65 divisions and 423 sub-divisions. A sub-division is the smallest unit in the system. Surat urban division, the focal area of this study, comprises of 6 sub-divisions. In addition part of the power supplied to Surat is from a private utility called the Surat Electric Company.

Surat urban division is an economically developed area and has had a very high industrial growth rate in the past. The division has a mix of consumers from the domestic, commercial, industrial and agricultural sectors. However since it is an urban division electricity consumption by agriculture is the lowest while the industrial consumption is highest. The domestic, commercial and industrial consumers are metered while agricultural supply is unmetered.

### *Electrical network*

Currently eight grid substations of 11 or 22 kV voltage cater to the consumers of Surat Urban Division. The electricity is distributed to the consumers through the HT and LT network. The HT network comprises 22 kV and 11 kV levels. The LT network comprises 0.44 kV level and more than two thousand 11 kV (22 kV)/440 V step down transformers are installed at various places under the division. The LT distribution network emanates from these distribution transformers and supplies power to the consumers. High voltage feeders are categorized into Urban LT, Urban Mix, Rural LT, Rural Mix, Industrial LT and Industrial Mix based on the connected load of different consumer categories. The conductor sizes of HT feeders (total 42 feeders, of which 3 are express feeders) are either dog or rabbit. The total capacity of the substations catering to the Surat Urban Division is 210 MVA. These are fed from different 220/66 kV substations at Vav, Kim, Besthan etc. (Annex 3 provides the information on existing substations and feeders from these substations)

### *Load pattern and consumption*

The total connected load of the Surat urban division as on March 2001 was 164 MW and the consumers catered to were 174000. In the year 2000-01 the total energy sent to various consumers from these substations was around 777 MU while the total electricity billed during the year was only 464 MU. Past data show that the annual losses in this division are mounting and commercial losses, which should ideally be zero, in the year 2000/01 were more than 35% , whereas the technical losses were 5.4%. Such large losses are due to poor metering arrangements, bill recording errors, poor vigilance, meter tampering etc.

The agricultural consumption being also adds to high commercial losses in the area. Of six subdivisions under the Surat Division, Surat (R) sub-division is predominantly industrial, while the Randar sub-division is predominantly domestic and Kamrej subdivision is predominantly agricultural.

### *Load growth*

Load growth in the Surat urban division has been significant in the last few years. To cope with the increasing load various system changes have been implemented. These consist of erecting new feeders, bifurcating existing feeders and load balancing between feeders. GEB has also proposed to construct a new substation in the area and the proposal for another sub-station is in the pipeline. Apart from this, bifurcation of a few feeders has also been proposed.

### *Institutional set up and activities*

The key function of electrical department of Surat Urban Division includes the maintenance of electrical network, issue of bills for energy consumed and collection of revenue, load planning and system improvement works, necessary steps to reduce T&D losses of the system and system improvement schemes such as bifurcation of over loaded feeders. These activities in the division are of continuous nature. The execution of key activities is distributed between different wings of the division such as commercial, maintenance, purchase and planning wing.

### *Metering arrangements*

Metering arrangements in the Surat urban division are not up to the mark. The meters installed at the substation are either electromechanical or they have a very high CT (current transformer) ratio. This increases the probability of errors occurring while recording the energy consumption. Many of the panel meters are digital, which are more accurate than electromechanical meters. There are no metering arrangements at the secondary side of the distribution transformers. Due to this, carrying out an energy audit becomes an almost impossible task. While meters at the premises of domestic and commercial consumers are of an electromechanical type , the meters at most of the HT industries are of the three phase digital type.

Available data suggest that 16.5% of the meters in domestic and commercial categories are either defective or not working. Billing of consumer's consumption is done on a periodic basis and the billing activity spans over a few days.

Existing network condition and managerial activities do not lead towards a sustainable future of distribution system either financially or environmentally. Changes are required at two fronts 1. Technical Changes and 2. Changes in managerial activities.

### *SYSTEM STUDIES AND ANALYSIS*

The following major steps were followed for the methodology and analysis in order to explore the best possible options for system improvement.

- All relevant data, necessary for system study and simulation were collected from the field. A survey was conducted by GEB personnel for the feeder map and consumer data. Other data about past load patterns; consumption and future pending connections were collected from the official records of the Surat urban division.
- Sampling of feeders was done for estimating the losses. Out of 42 feeders, 18 were identified for estimating losses in the 11 and 22 kV feeders by selecting at least two feeders from each substation. Feeders were categorized into 8 based on the maximum current in the feeder and about 50% of the feeders under each category were identified for detailed analysis. All the distribution transformers on these feeders were categorized

based on their capacity. At least three transformers under each category were selected based on the LT length, for estimating the losses in the LT network.

- Feeders of 22 and 11 kV level were simulated on the computer in order obtain a realistic technical loss assessment in HT lines. Losses in LT systems were also estimated using computer software for LT system.
- In order to estimate the year wise anticipated losses corresponding to the period 2001/06 , a load forecast has been carried out based on the pending connections in the different subdivisions, past consumption trend and detailed discussions held with the concerned divisional/subdivisional officials of the Surat urban division.
- The existing system was analyzed feeder-wise for the present and the anticipated load conditions. The anticipated technical losses were estimated based on the corresponding computer results.
- System studies were conducted on the computer to explore and analyze various options for system improvement to reduce technical losses.

The following tables give the overview of losses in the base year (2000/01) and in the remaining years (2001/06) and the net saving achieved by implementing the system improvements works.

**Table 1. Saving in technical losses due to system improvement.**

| Year | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 |
|---|---|---|---|---|---|---|
| **Base case (MU)** | 41.32 | 49.81 | 56.83 | 63.51 | 69.34 | 72.97 |
| **Alternate case (MU)** | 41.32 | 46.50 | 52.68 | 56.75 | 61.95 | 65.03 |
| **Saving (MU)** | 0 | 3.31 | 4.15 | 6.77 | 7.39 | 7.94 |

## EXPECTED PROJECT OUTCOMES, WITH UNDERLYING ASSUMPTIONS AND CONTEXT

Meeting the load growth was the governing factor behind all the past activities of system changes. The proposed project leaps one step ahead with the main objective being to reduce the $CO_2$ emissions and measuring benefits against the reduction in $CO_2$. The above mentioned analysis and information on managerial activities provides the base for appropriate technical and managerial solutions to meet the global and specific objective of loss reduction.

The execution of the project will involve three components, they are

1 System improvements to reduce the technical losses (this will also increase the reliability of the system)

2 Appropriate managerial set up
3 Manpower training

### *System Improvement*

This activity will reduce the technical losses in the system. The activities involved in successful system improvements are a) Data collection and analysis b) Load forecast c) System simulation d) Selection of various options e) Detailed analysis and implementation of each option.

Distribution systems are very dynamic in nature and load growth is a continuous process. Depending on the trend in load growth system design, options for improvement also vary accordingly. Thus a realistic estimate of existing and future load is an essential and crucial component. Data collected from the field about network condition/parameters, connected load and pending connections are the backbone of analysis.

### *Options for System Improvements*

A detailed analysis of the data and the results of the power system studies suggested the following measures be taken to reduce technical losses:-

1 Construction of two new substation
2 Bifurcation of feeders
3 Erection of new feeders
4 Replacement of LT lines by Aerial Bunched Conductors

> The construction of two new substations will cost around Rs 700 lakhs as it involves the erection of transformers, panel meters and all the necessary safety equipment and infrastructure. The two proposed new substations, Pal and Puna, will each have a capacity of 50 MVA. Pal substation is proposed to cater to Randar area of the Surat Urban Division, which is currently catered to by the Icchapore substation. This will reduce the total HT line length.

Keeping in view the future load growth in the Randar area, it is also proposed to erect new feeders by rebalancing and redistributing the load on existing feeders.

The existing feeders Randar 1, Randar 2 , Randar 3 and Adajan will be bifurcated to create three new feeders which are Randar 1, Randar 2 , Randar 3, Adajan Krishna, Kasturba and Sahej. All these feeders will be shifted to the new Pal substation.

Bifurcation of Tapi U, Saroli, Kamrej feeders and creation of a new feeder are proposed to meet the future load growth in the Surat (R) sub division. The erection of another substation at Puna is also proposed under Surat (R) subdivision. The bifurcated portion of Tapi U, Saroli, Kamrej and new feeder will be shifted to the new Puna substation. This project also suggest the bifurcation of Jiav, IndSouth, Ram Nagar, and Randar T feeders. Annex 4 gives the information about the substation and the feeders from these substations in th alternative case.

### Technical solution to reduce commercial losses

Theft of electricity by hooking from overhead bare conductors is a common feature in th Indian electricity distribution system. Based on information from the division office wherever the theft of electricity by hooking is high, replacement of LT line by Aerial bunche conductors is proposed.

These system improvement activities will increase the capacity of the existing system to mee future load growth without overloading. A significant reduction in technical losses will be th main outcome of these activities.

All the above mentioned activities will reduce the generation requirement to meet the sam load resulting in less $CO_2$ emissions to the atmosphere. In order to arrive at a reduction i carbon into the atmosphere, an emission factor i.e. tonnes of carbon per unit has been used This emission factor has been calculated by taking into account the generation mix from various fuel sources supplying power in the area and the emission of carbon from each fue source for a unit generated.

### Options for reducing commercial losses (metering, billing, managerial)

The main objective of this activity is to establish a proper metering and billing system, creat vigilance squads to monitor and catch the theft of electricity and any other supportiv administrative system.

Proper metering arrangements improve energy accounting and make an energy audit easier this paves the way for commercial loss reduction in the area. This project proposes to instal meters at each and every distribution transformer in the division and to replace the existin electromechanical meters in domestic, commercial and industrial consumer category b digital/static/high precision meters.

In order to take full advantage of the metering system in place, proper meter reading an periodic checking of the past consumption of a consumer becomes an important issue. Thi demands adequate trained manpower. At present the division does not have traine manpower to carry out metering and billing activities. Periodic checking of a consumer' consumption pattern will help to curb the theft or tampering of meters. Heavy penalties ca and should be levied if a consumer is found to be guilty of theft. This project proposes th following activities to improve the billing system: -

1 Set up an adequate number of computers and associated infrastructure
2 Staggered and periodic checking of consumption patterns of consumers and conducting energy balance analysis
3 Distribution-wise identification of consumers

As mentioned earlier, the successful implementation of this new system requires trained manpower and periodic evaluation of trained manpower. At present there is no HR cell, which can assess and execute the training requirement based on need. This project proposed to set up a human resource cell at divisional level with a clearly defined role to perform the following activities on a need basis 1. Assessing the need to give effective and fruitful training 2. Designing a suitable training programme 3. Imparting training 4. Monitoring and evaluation of all training activities as well as the periodic evaluation of trained manpower.

A vigilance squad will be set up at divisional level, which will monitor consumer activity periodically to curb the theft of electricity and to identify any illegal connections. The vigilance squad should be staffed with adequate security personnel and given magisterial powers so that proper legal action is taken against consumers stealing power.

Implementation (system improvement and managerial set) is expected to reduce the technical losses from 5.4 % to 4.5 % and commercial losses from 35 % to 7.1 % at the end of the study year, 31 March, 2006.

Any activity carried out for commercial loss reduction will have a broader impact and better results if the outcome of activities are properly disseminated. This will be achieved by organizing workshops and training programmes at the state level involving suitable persons.

## SCOPE AND REPLICATION

The successful implementation of the project as described in the earlier two sections will result in cost-effective outcomes which are in line with GEF objectives. On the one hand system improvement will improve the quality of power supplied and on the other hand, it will improve the cash flow in the division as well as benefit the environment. The managerial system set up will help in removing the barriers, such as delays in implementation, and inefficiencies in the process.

The project if implemented as per the schedule and in an efficient manner will reduce the distribution losses in Surat Urban Division to a significant level.

Curbing of theft due to elasticity of price will reduce consumption in the area, which will directly reduce the generation requirement to meet the same demand resulting in reduced $CO_2$ emission in to the atmosphere. These activities meet the specific and global objective.

The situation is a win-win one and if replicated at a broader level can improve climate conditions as well as the financial health of the utility.

## SUSTAINABILITY ANALYSIS AND RISK ASSESSMENT

### *Financial sustainability*

The financial health of utilities in India is very poor. A host of reasons, such as high losses, inefficient billing, poor revenue realization, cross subsidies and inappropriate energy pricing, can be attributed to this. Due to poor revenue realization utilities are cash strapped and unable to invest in upgradation of their networks. The activities carried out in this project will result in increased revenue realization for the utility, which will provide positive cash flow in the future as well. Also, the capital invested in activities will be recovered in the next three and half years. The 40 % of the total revenue realized from this project will be utilized in the project itself while the balance will be used to create a revolving fund for the utilization in other project. This will make the project financially sustainable.

### *Environmental impact*

Activities undertaken as part of this project in area of the Surat division will not have any negative impact on the environment. Far from it these activities will have a positive impact on the global environment due to a decrease in distribution losses and avoided generation. The local environmental impacts in areas where generation plants are located will be significantly ameliorated due to a reduction in water requirement of power plants and thus reduced water contamination, reduced fly ash amounts and emissions into the atmosphere. The other indirect global benefits of this project are that the use of portable DG set and its harmful impacts will gradually decrease. Thus this project is environmentally sustainable.

### *Risk associated with the project*

The major risks involved with the project are related to implementation of the loss-reducing activities:-

Implementation may be delayed due to consumer resistance, absence of political will to take up the work, legal disputes etc. The risks associated with this project may be broadly classified into two components

- Risk involved in system improvement: The main risks associated with the system improvement could be, 1. Non cooperation of consumers in providing data 2. Load growth may not be consistent with forecasted load 3. Non availability of space due to illegal constructions in the area or procedural delays.
- Risk involved in design and implementation of managerial framework for reducing commercial losses: This project suggests the replacement of existing meters by digital meters. The availability of meters in adequate numbers is essential. The implementation requires synchronization between different activities and the availability of adequately trained manpower. Effective coordination and communication among various wings of the division is very important. In absence of this, the implementation procedure may

suffer. Availability of computer facilities for a proper billing system and trained manpower for metering and billing is key to successful implementation.

These risks can be avoided by adequate and comprehensive training of manpower and setting up a full fledged HR division. Any procedural delays can be avoided by synchronizing the work among various wings and activities. Monitoring and evaluation procedures if adequate and efficient can give additional support to the fulfillment of objectives.

**Stakeholder involvement and social assessment**
The direct stakeholders in this project are the Gujarat Electricity Board and the consumers. The consumer's wholehearted involvement is the key to the success of the project. GEB will be involved to the extent of successful execution of the activities. It will be benefited by the improved cash flow, more dependable electrical system and an improved reliable supply for its consumers. Its financial viability will be thus enhanced.

The outcome of this project is not only restricted to system improvements and good realization but will also have hidden social benefits. System improvement will lead to a reliable supply, increased power availability, less power outages etc. Reduction in outages and improvement in power availability will restrict the consumers from adopting other means for meeting power requirement, which may have an adverse environmental impact such as emissions from DG sets. Also consumers are not aware of the cost of back up power supply because they treat the investment in inverters and DG sets as a sunk cost. Reduction in outages will improve the productivity in the area as well.

## Incremental Cost Assessment

The incremental cost of any alternative action is measured against a baseline representing the situation that would otherwise exist. It is therefore a reference value which indicates the additional burden that a country would bear if it were to obtain the services provided by the original activity (the baseline) in another way, for example, by taking into account global environmental concerns.

This project aims at reducing technical and commercial losses in the distribution system of the Surat Urban Division of the Gujarat Electricity Board (GEB), Gujarat. There are therefore two aspects to this project: system improvements undertaken to reduce technical losses, and the metering arrangements/billing, monitoring and managerial measures taken to reduce commercial losses.

In the baseline, representing the 'Business as Usual' scenario, Gujarat Electricity Board (GEB) continues its activities as it has been doing in the past. Through this broad statement, we can take into account the improvements and changes that GEB would be carrying out anyway, irrespective of whether this project is sanctioned by GEF or not. This project therefore is essentially complementary in nature, in as much as it seeks to conduct system improvements and reduce commercial losses of the Surat Urban division of the GEB. All the activities that are proposed under this project will be taking place alongside the activities of the GEB.

It is assumed that the changes driven by increase in consumer load demand will continue to happen for example, the creation of a new substation, Pal, will take place even if GEF financing is not available. So, the baseline situation comprises the following:

- Creation of the Pal substation
- Bifurcation of Saroli feeder
- Routine operation and maintenance work

The alternative situation comprises activities for reducing both technical and commercial losses.

Technical components/system improvements are:

- Bifurcation of Randar1, Randar2, Randar3, Adajan feeders
- Bifurcation of Tapi and Kamrej feeders
- Further bifurcation of Saroli into Saroli and Vikram Nagar
- Bifurcation of Jiav, Saroli, Tapi U, Ramnagar, IndSouth, Randar T
- Creation of a new substation named Puna

***To reduce commercial losses***

- Installation of digital meters with memory banks
- Installation of computerized billing systems
- Capacity-building/training of manpower
- Setting up a vigilance squad to check pilferage and thefts
- Setting up a Human Resource Cell at divisional level
- Evaluation and monitoring of the above activities. This would include physical verification of installation of meters, meter readings, and energy audits.
- Information dissemination for easy replication of the concept elsewhere in Gujarat as well as all over India.
- Other miscellaneous costs.

The entire gamut of activities is expected to be completed within five years, with the base year being 2000/01.It is assumed that the time frame set for implementation of different activities relating to reduction of technical and commercial losses is adhered to. The Net Present Value of inflows and outflows has been calculated, assuming a discount rate of 12% and an Operations and Maintenance rate of 12%.

Price elasticity of electricity demand refers to the general impact of electricity price changes on electricity consumption. This is a measure of the percentage change in demand resulting from a percentage change in price. Here the concept of price elasticity is being applied to electricity consumption. In 1998, a study was conducted by TERI titled "Elasticities of electricity demand in India". This study estimated price and income elasticity in 19 Indian states spread over 9 years, for residential, agricultural, commercial, and industrial categories of consumers. For this project a very conservative estimate of price elasticity has been taken at -0.26. As activities are being implemented in phases the commercial losses are expected to be reduced drastically. Higher energy bills due to decrease in commercial energy losses will lead to reduced electricity consumption. The energy thus saved will result in avoided generation.

The incremental cost matrix for the project is given in Annex 7. The incremental cost for the complete project (which is essentially complementary) is estimated to be US$14252990. In this matrix, we have summed up the costs for all the years so that they can be incorporated into a single column. The project is actually implemented over five years, starting from 2001/02. For the actual detailed calculation, please refer to the Excel worksheet attached as Annex 10.

## Project Budget

The total budget for the project is estimated at around US $14.32 million. The project budget has been calculated up to year 2010-11, including the five-year actual implementation and execution period. The project budget includes the cost of system improvements to reduce technical losses, measures to reduce commercial losses, information dissemination costs to enable application of the model to the rest of Gujarat as well as over India and finally the project development fund. Annex 8 gives the breakup of the proposed project. The entire budget for the project, except the cost of disseminating information about its success, will be utilized over a period of 5 years.

Capital investment for system improvement, and reducing commercial losses is estimated at around US $13.62 million. These activities are complementary to what the Gujarat

Electricity Board (GEB) is currently engaged in, and will greatly increase its financial viability. Therefore, it is proposed that the GEB will co-finance part of the project to the extent of about US $0.625 (million).

Details of expenses are explained in the project budget (Annex 8).

## Public Involvement Plan

### *Stake Holder Identification*

Apart from UNDP, GEF, GEB and consumers, who are the main stakeholders in this project, meter manufacturers, equipment suppliers are the indirect stakeholders in this project. A list of all possible stakeholders is attached in Annex 2.

### *Stakeholder Participation*

Meter manufacturers and equipment suppliers will have to play a major role in the implementation of the project. This project requires a very large number of meters to be installed. Similarly to achieve system improvements, high quality equipment will be required and discussions with concerned authorities to draw appropriate specifications for the equipment.

The participation of the government of Gujarat and relevant ministries is vital to the success of the project, as the policy decisions relating to management of GEB, any policy changes and removal of barriers through a proper policy framework are under the purview of the GoG/ministries.

Also the cooperation/synchronization among divisions of GEB, among different wings of the Surat Urban Division and among the ministries is essential and finally an important pre-condition for the success of the project.

### *Information dissemination and consultation*

It is proposed to conduct workshops/seminars as part of the activity to generate awareness among various stakeholders and others who are directly or indirectly benefited by the project. Involvement of NGOs and consumer groups should be the main objective of the information dissemination process to help them understand the implications of the proposed project in the short and long term. Both global as well as domestic benefits will be discussed information will be widely disseminated by using appropriate media.

The project budget has sufficient provisions for such complementary activities, which include the dissemination of the information generated through the workshop and/ or seminars.

*Social and participation issues*

This project will have an indirect impact on the social life of consumers. Benefits will be widely discussed with the consumers and they will be encouraged to use electricity judiciously. Social assessment will be done by interacting with consumers and consumers bodies and analysis made against benefits such as reliable supply, reduction in shortages, $CO_2$ emission.

## Monitoring and Evaluation Plan

Monitoring and evaluation are integral parts of the project and the most important factor in the success of the activities. Monitoring will be done by a committee, which will have experts from a spectrum of areas to evaluate the progress and status of the project.

1. The main objective of the project is to reduce technical and commercial losses. It is very important to have real data in order to analyze the reduction in losses and fulfillment of objectives. To do this the constituted committee will collect the data from the field on a random basis and from any other sources such as official records. This data will be analyzed to know whether the objective has been achieved or not.
2. The committee will examine the indicators of each activity and will verify the indicator to arrive at the outcomes.
3. The committee will ensure the activities for commercial loss reduction such as meter procurement, installation, checking and replacement of LT lines by Aerial Bunched Conductors are adhered to their scheduled as planned.
4. The activities will be monitored on a regular basis by the committee
5. Training of manpower and setting up an H R cell at divisional level is a key issue in implementation. Evaluation of training will be done by getting feedback from the participants and holding the discussion at various training programmes.
6. Evaluation of trained manpower (whether the training given to them has been productive) is also suggested.
7. Periodical discussions will be held with stakeholders to get suggestions. These would then be fed into the implementation process resulting in an increase in the implementation efficiency.

## Logical Framework Analysis

| PROJECT STRATEGY | Objectively verifiable indicators | Sources of verification | Critical Assumptions and Risks |
|---|---|---|---|
| **OBJECTIVES** | | | |
| **GLOBAL OBJECTIVE-**<br>Climate stabilization by reducing $CO_2$ emissions | Quantified $CO_2$ emission reduction over the life time of the project | National GHG inventories and reports to UNFCCC | Consistency with GOI policies and priorities |
| **SPECIFIC OBJECTIVE-**<br>Reduction in technical and commercial losses in the distribution system of Surat Urban Division | ▪ Increase in revenue collection<br>▪ Energy Audit | ▪ Electricity bills<br>▪ Energy Audit Report | ▪ Timeframe set for implementation of options are adhered to<br>▪ Load forecast is fairly reliable<br>▪ Assumed load factor holds good<br>▪ Accuracy of metering and billing are reliable<br>▪ Time consistency in billing cycle<br>▪ Maintenance of equipment is done at regular intervals |
| **IMMEDIATE OBJECTIVE (1)-**<br>System improvements to reduce technical losses | ▪ Quality of supply<br>▪ Improved voltage<br>▪ Reduction in Current<br>▪ Reduction in failure rate of transformer | Meter reading,<br>Official record | ▪ Power factor remains the same<br>▪ Load growth may not be consistent with load forecast<br>▪ Non availability of space due to Illegal construction in the area |
| **OUTPUTS:** | | | |
| System Changes | ▪ Increase in number of substations/transformers<br>▪ Changes in HT and LT length of | Official records | • Resistance from consumers for Right of Way<br>• Synchronization between |

|  |  |  |  |
|---|---|---|---|
|  | feeders<br>▪ Change in type of conductor |  | different activities |
| **ACTIVITIES:** |  |  | • Resistance from consumers<br>• Trained manpower is available<br>• Litigation |
| **ACTIVITY (1.1)-**<br>Data collection feeder-wise: load data, system parameters etc | Field survey report | Official Records |  |
| **ACTIVITY (1.2)-**<br>System simulation | Files in computer | Computer generated results |  |
| **ACTIVITY (1.3)-**<br>Feeder-wise load forecast | Data Analyzed | Official Records |  |
| **ACTIVITY (1.4)-**<br>System simulation and result analysis | Files in computer and soft copies | Computer generated results |  |
| **ACTIVITY (1.5)-** IDENTIFICATION OF OPTIONS TO REDUCE TECHNICAL LOSSES | Results of the analyzed data | Computer generated results and Official Records |  |
| **ACTIVITY (1.6)-**<br>BIFURCATION OF FEEDER | Increase in number of feeders | Official Records, Physical verification |  |
| **ACTIVITY (1.7)-**<br>SUBSTATION CONSTRUCTION | Increase in number of substations | Official Records, Physical verification |  |
| **ACTIVITY (1.8)-**<br>Reconductoring | Increased current at the substation | Physical verification |  |
| **Immediate Objective (2)-**<br>Design a managerial framework for reducing commercial losses | ▪ Vigilance Squad<br>▪ Metering Arrangements<br>▪ Computerization of billing systems | ▪ Physical verification of installations and cross-checking with records<br>▪ Changes in administrative practices | ▪ Trained manpower available<br>▪ Effective coordination and communication among various wings of the division.<br>▪ Political will to support the changes |
| **OUTPUTS:** |  |  |  |

|  |  |  |  |
|---|---|---|---|
| ▪ Reduction in commercial losses<br>▪ Increase in Revenue<br>▪ Better metering arrangements<br>▪ Better billing system | Changes in energy sent and billed<br>Divisional records<br>Timely delivery of accurate and computerized bills | Energy audit and records<br>Sample checking and energy audit<br>Memory record of meter<br>Computer records of divisions | ▪ Cooperation of consumers<br>▪ All meters are in working condition<br>▪ Proper maintenance of records<br>▪ Meters purchased as per specifications<br>▪ Availability of required quantity of meters |
|  |  |  |  |
| **ACTIVITIES:** |  |  |  |
| **ACTIVITY (2.1)-**<br>Installation of digital/Static/High precision meters | purchase records | Physical verification | • Timely availability of meters in adequate numbers<br>• The vigilance Squad has been given with magistrate power<br>• Synchronization of different activities |
| **ACTIVITY (2.2)-**<br>Computerized billing | Computerized set up | Generated bills and files |  |
| **ACTIVITY (2.3)-**<br>Setting up of managerial system including vigilance squad | Changes in administrative system | Official record |  |
| **Immediate Objective (3)-**<br>Capacity building through awareness and Training of Manpower | Training material and course Trained manpower | Records available in HR division |  |
| **OUTPUTS:** |  |  |  |
| H R Cell at division level | Administrative set up/ HR division | Verification through visits and official record | • Experts for various activities are available for training<br>• Adequate managerial power has been given<br>• Training has been effective |
| Trained manpower | Availability of trained manpower, Certificates awarded | Divisional HRD records |  |

| **ACTIVITIES** | | | |
|---|---|---|---|
| 3.1 Need Assessment | Interview with HR Division | Report generated | • H R Division functioning is efficient<br>• There is willingness among manpower to learn<br>• Monitoring and evaluation procedure is adequate and efficient<br>• Regular evaluation of trained person through his performance book |
| 3.2 Designing of Training Programme | Interview with HR Division | | |
| 3.3 Imparting training | Schedule of training and course material | • Physical verification<br>• Records available with HR division | |
| 3.4 Monitoring and Evaluation of training | Performance book of a person | Official records | |

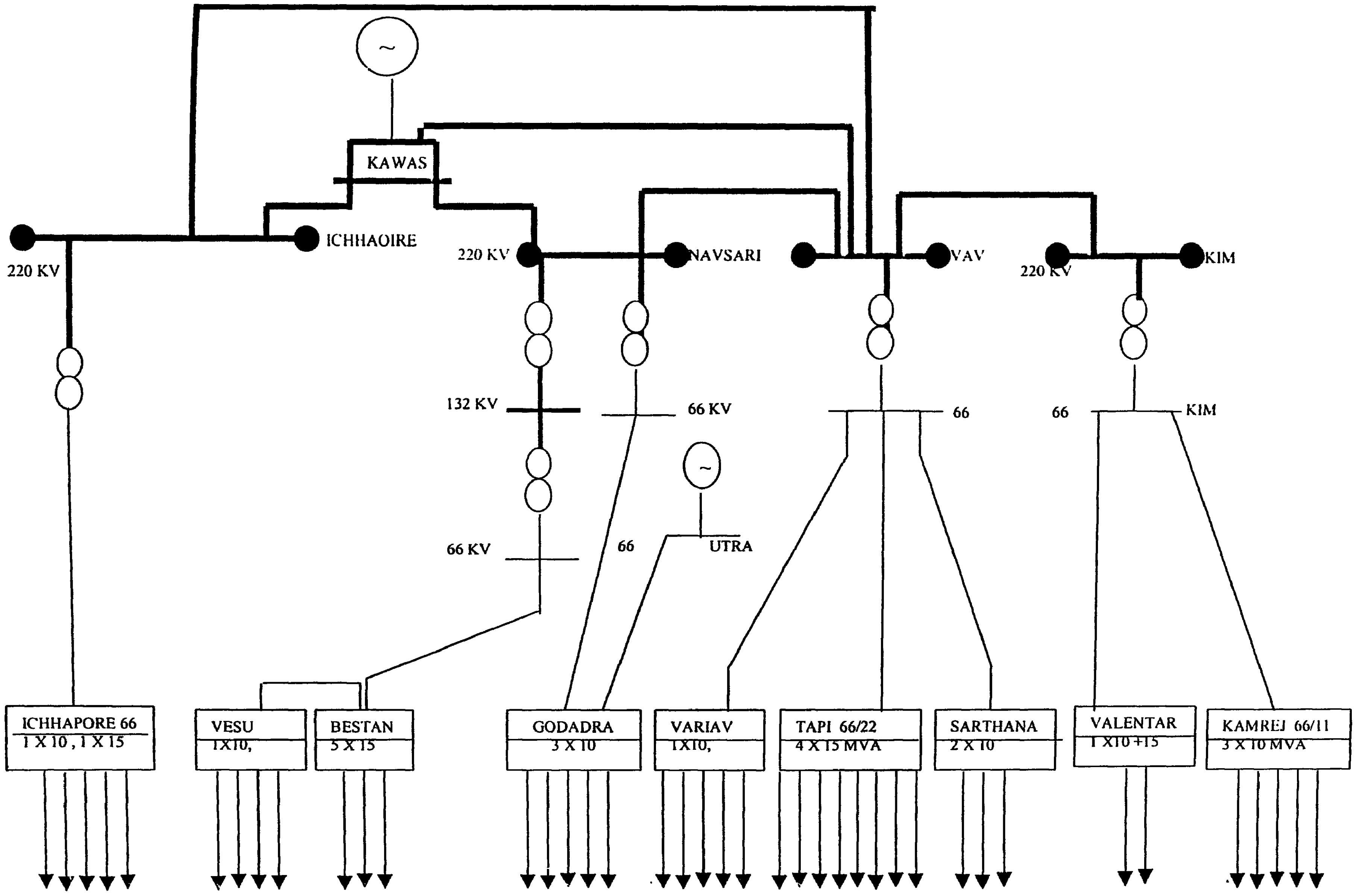
## ANNEX 2

# LIST OF STAKEHOLDERS

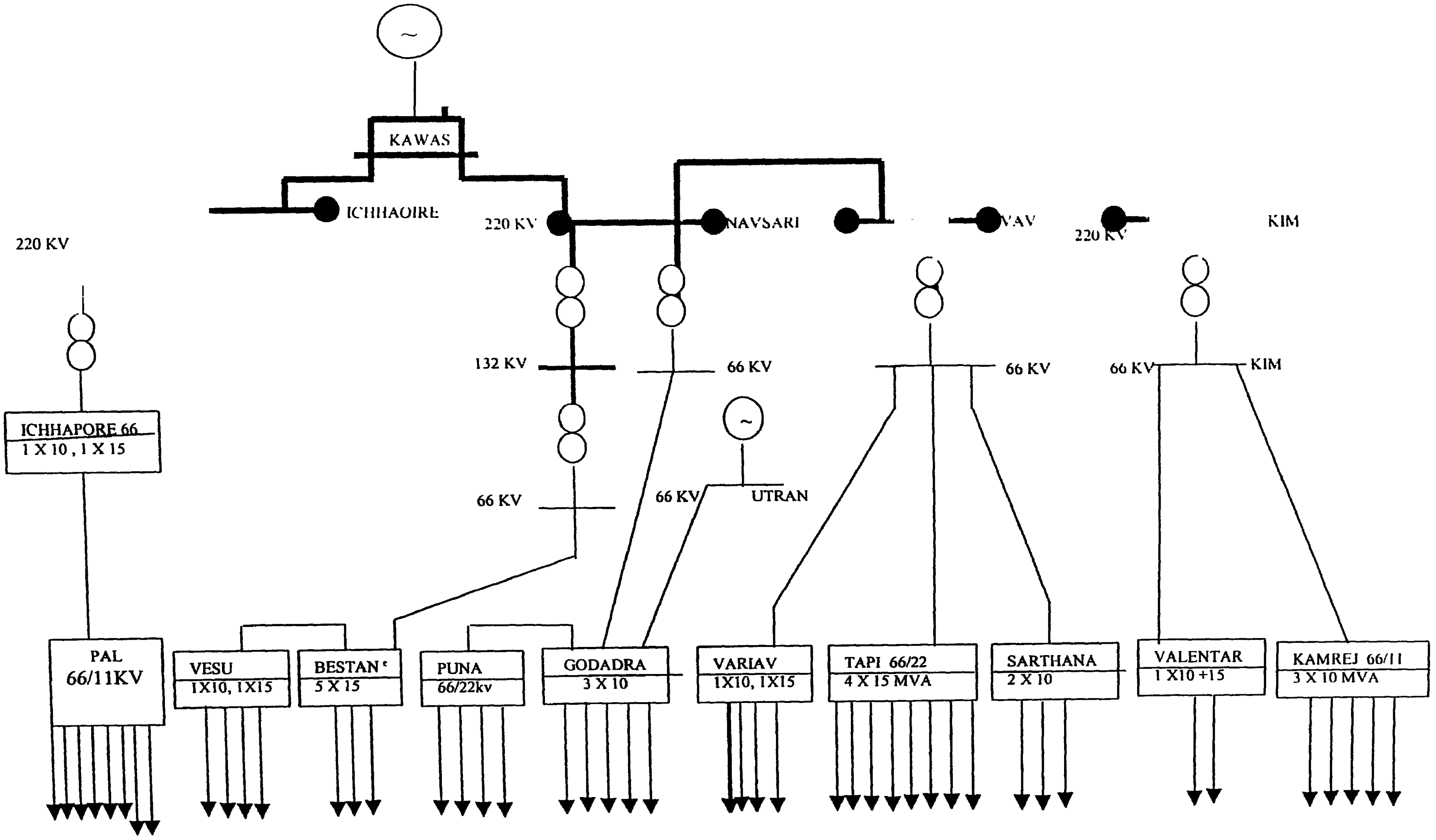
1 Consumers of Gujarat Surat Urban Division
2 Gujarat Electricity Board
3 Social group of Surat Urban division
4 Government of Gujarat
5 Equipment suppliers
6 Meter manufacturers
7 UNDP-GEF
8 Gujarat Electricity Regulatory Commission

ANNEX 3

# EXISTING ELECTRICAL NETWORK



# PROPOSED ELECTRICAL NETWORK



# Annex 5

## Outcome of different activities

| **Activities:** | **Outcomes** |
|---|---|
| **Technical** | |
| 1. System Improvements | • Two new substation Pal and Puna<br>• Shifting of load from Icchapore substation to Pal substation<br>• Increase in number of feeders bue to bifurcation and redistribution of load of existing feeders<br>➢ Bifurcation of Randar1, Randar2, Randar 3 and Adajan and creation of four new feeder: Krishna, Sahej, Kasturba, sridhar<br>➢ Bifurcation of Tapi U, Kamrej, Saroli and creation of new feeder<br>➢ Bifurcation of Jiav, IndSouth, Ramnagar and Randar T<br>➢ Further bifurcation of saroli, Tapi U and creation of 3 new feeders by redistribution load<br>• Replacement of LT length at few transformers by Aerial Bunched Conductors<br>• Reconductoring of Saroli feeder<br>• **Reduction in technical losses** |
| Managerial Activities | ➢ Meter installation at each transformer and consumers premises (digital/Static/High Precision meters )<br>➢ Computerization of billing<br>➢ Vigilance squad at divisional level<br>➢ Human Resource Cell at divisional level<br>➢ Trained Manpower |

| | |
|---|---|
| | ➢ **Reduction in commercial losses**<br>➢ Increase in revenue<br>➢ **Reduction in consumption in the area** |

# Annex 6

Year wise load growth and losses in the base year in the division

| Year | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 |
|---|---|---|---|---|---|---|
| Load MW | 163 | 195 | 220 | 244 | 265 | 284 |

Comparison of losses

| | **Base year (2000-01)** | | **After implementation in year 2005-06** | |
|---|---|---|---|---|
| Total Input MU | 777 | | 1469 | |
| Total Loss MU | 313.32 | | 177 | |
| Technical Loss MU | 41.32 | 5.4 % | 73 | 4.5 % |
| Commercial Loss MU | 272 | 35 % | 104 | 7.1 % |

# Annex 7

**Incremental cost matrix (all values PV @12%)**

| | Baseline | Alternative | Increment (Alternative Baseline) |
|---|---|---|---|
| Global Environmental Benefits<br>▪ Total $CO_2$ emissions (during the entire life of plant) tons | | | |
| Domestic benefits | | | ▪ Increase in revenue collection<br>▪ Better quality of power supply<br>▪ GEB's viability improves<br>▪ Increased efficiency of GEB<br>▪ Higher power factor and thus better operation of all facilities and equipment<br>▪ Avoided generation, leading to energy savings.<br>▪ Better load management<br>▪ Better customer service<br>▪ Energy conservation by consumers<br>▪ Better trained and equipped manpower<br>▪ Better vigilance, including a monitoring system<br>▪ Better coordination among different wings of the division |
| Costs (in Indian Rupees) | | | |
| I. To reduce technical losses: | | | |
| ▪ System improvements | 0 | 1815402 | 1815402 |
| II. To reduce commercial losses: | | | |
| ▪ Aerial Bunched Conductor | 0 | 200000 | 200000 |
| ▪ Installation of better metering arrangements | 0 | 9488722 | 9488722 |
| ▪ Installation of computerized billing | 0 | 15416.67 | 15416.67 |

|  |  |  |  |
|---|---|---|---|
| systems |  |  |  |
| ▪ Training of manpower | 0 | 1,01751.7 | 1,01751.7 |
| ▪ Set up of a managerial system | 0 | 305255 | 305255 |
| ▪ Setting up of vigilance squad | 0 | 95392.19 | 95392.19 |
| III. Evaluation and monitoring | 0 | 0 | 0 |
| IV. Information dissemination for easy replication of the concept elsewhere in Gujarat as well as all India | 0 | 15625 | 15625 |
| V. Other costs (Software packages + O&M cost ) | 0 | 2215425 | 2215425 |
| **Total costs in US$** |  | 14252990 | 14252990 |

US $1 = Rs. 48.0

**How has the actual cost of $CO_2$ abatement been calculated?**

*For each of the years from 2000-01 to 2010-11*

The cost mentioned above has first been adjusted for savings due to price elasticity and avoided generation. As described previously, a price elasticity index of –0.26 has been taken. Corresponding to this, avoided generation has also been accounted for, and so we arrive at Net Cost.

The method takes into account the fact that depreciation is a non-cash outflow. It also considers the revenue increase that results from reducing commercial losses. So, the only expenditure is the O&M cost. This O&M cost is added on to the Capital Cost to get a Total Expenditure

Then, the revenue increase due to better metering and billing arrangements, better vigilance etc is also taken into account. These are treated as revenue inflows. Here an assumption is made: - since the meters are not installed all at the same time, their benefits will also be realized only gradually, i.e. 25% of benefits in first year of realization, 75% of benefits in the second year, and 100% thereafter.

Annex 8

## Project Budget (all numbers in United States Dollars)

| Component | GEF Financing | Other Sources (GEB) |
|---|---|---|
| PDF | 62500 | |
| Project Costs | | |
| I. System improvements to reduce technical losses | 1190402 | 625000 |
| II. Measures to reduce commercial losses | | |
| ▪ Aerial Bunched Conductor | 200000 | |
| ▪ Installation of better metering arrangements (digital meters with memory banks for more than 200,000 customers) | 9488722 | |
| ▪ Installation of computerized billing systems: | | |
| ✓ Computers & other infrastructure (10 computers @ Rs 50,000 each) +Other running cost for rest of the implementation period | 15416.67 | |
| ▪ Training of manpower | | |
| ✓ Set-up of a HRD division in Surat Urban Division (with a staff of one senior manager and 2 junior managers. Senior manager to be paid Rs. 20,000/mo and the 2 junior managers each Rs. 15,000/mo) | 76313.7 | |
| ✓ Process & Equipment (OHP, video-audio visual aids etc, conducting the training, inviting dignitaries, faculty etc) | 25438 | |
| ▪ Set up of a Managerial System | | |
| ✓ More staff (30 more staff needed to separate out metering and billing functions and increase | 305255 | |

| | | |
|---|---|---|
| efficiency of the system – their salary = 30*Rs.7,000/mo*12 months)<br>✓ Facility<br>✓ Process | | |
| ▪ Setting up a Vigilance Squad | | |
| ✓ A Vigilance officer with 4 deputies – Rs.15,000/mo + Rs. 8000/mo*4 = Rs.47,000/mo | 71733.2 | |
| ✓ Transport allowances @ Rs. 500/day for 300 days p.a. | 19079.2 | |
| ✓ Sundry expenses @ Rs.3000/mo for 12 months (hiring exps, maintenance of vehicles, etc) | 4580 | |
| ▪ Evaluation and Monitoring | 0 | |
| ▪ Information dissemination for replication of the concept elsewhere in Gujarat as well as all India (through workshops, seminars, conferences etc held at regular intervals) | 15625 | |
| ▪ Other costs (Software Packages + O&M cost) | 2215425 | |
| Total GEF Project Cost in US$ | 13627990 | |
| Total Project Cost (TPC+GEB) in US$ | 14252990 | |
| Project Total (PDF+TPC) in US$ | 14315490 | |

# Annex 9

## Assumptions

### General

1. The network status as on September 2001 has been considered
2. Capital cost estimates are liable to variation depending upon the exchange rate fluctuation.
3. In order to calculate the avoided generation (due to reduced consumption in Surat Urban Division) at generating point, 3 % transmission losses have been taken (apart from existing technical and commercial losses in Surat Urban division).
4. Category wise commercial losses have been calculated by distributing the existing total commercial loss of 272 MU based on the consumption in the respective category.
5. Existing commercial losses in domestic, commercial and industrial category have been considered for reduction and avoided generation purpose.

### System Improvements

1 Timeframe set for implementation of options are adhered to
2 Load forecast is fairly reliable because in actual practice load growth may not be consistent with load forecast
3 Load factor will remain same in the next five year
4 Maintenance of equipment is done at regular intervals
5 Power factor remains the same
6 In order to meet the increased load demand during the period 2004/2011, it is assumed that any changes required in the system will be taken care of by GEB under the annual budget of GEB, such as creation of new substations, augmentation of transformers or bifurcation of feeders

### Managerial and Institutional improvement

1 Accuracy of metering and billing are reliable
2 Time consistency in billing cycle
3 Enough land is available for any construction in the area
4 There is possibility of resistance from consumers for Right of Way
5 Synchronization between different activities exists
6 Trained manpower is available
7 Effective coordination and communication among various wings of the division
8 Political will to support the changes
9 Cooperation of consumers
10 All meters are in working condition
11 Proper maintenance of records
12 Meters purchased as per specifications
13 Availability of required quantity of meters

14 Timely availability of meters in adequate numbers
15 The vigilance squad has been given magisterial powers
16 Experts for various activities are available for training
17 Adequate managerial power has been given
18 Training has been effective and H R Division functioning is efficient
19 There is willingness among manpower to learn
20 Monitoring and evaluation procedure is adequate and efficient
21 Regular evaluation of trained persons through his performance book will be done

## Incremental cost calculation

1. No load growth after the 2010/11 due to non availability of space for further expansion
2. There will not be any increase in carbon saving after 2010-11.
3. Price elasticity has been taken as −0.26
4. Meter installation will be in phased manner hence it is assumed that the benefits due to this in first year would be 25% of the total meters, in second year it would be 75% from third year would be 100%.
5. Operation and maintenance cost has been taken as 12% of the capital investment
6. In order to arrive at the total number of single phase and three phase meters in base year 2000/01, the single phase, three phase division is done on a pro rata basis (taking the number as of today)
7. Revenue realization has been taken as Rs 3.38 per unit in the base year
8. Impact of Inflation has not been taken into account due to the very short gestation period of the project.

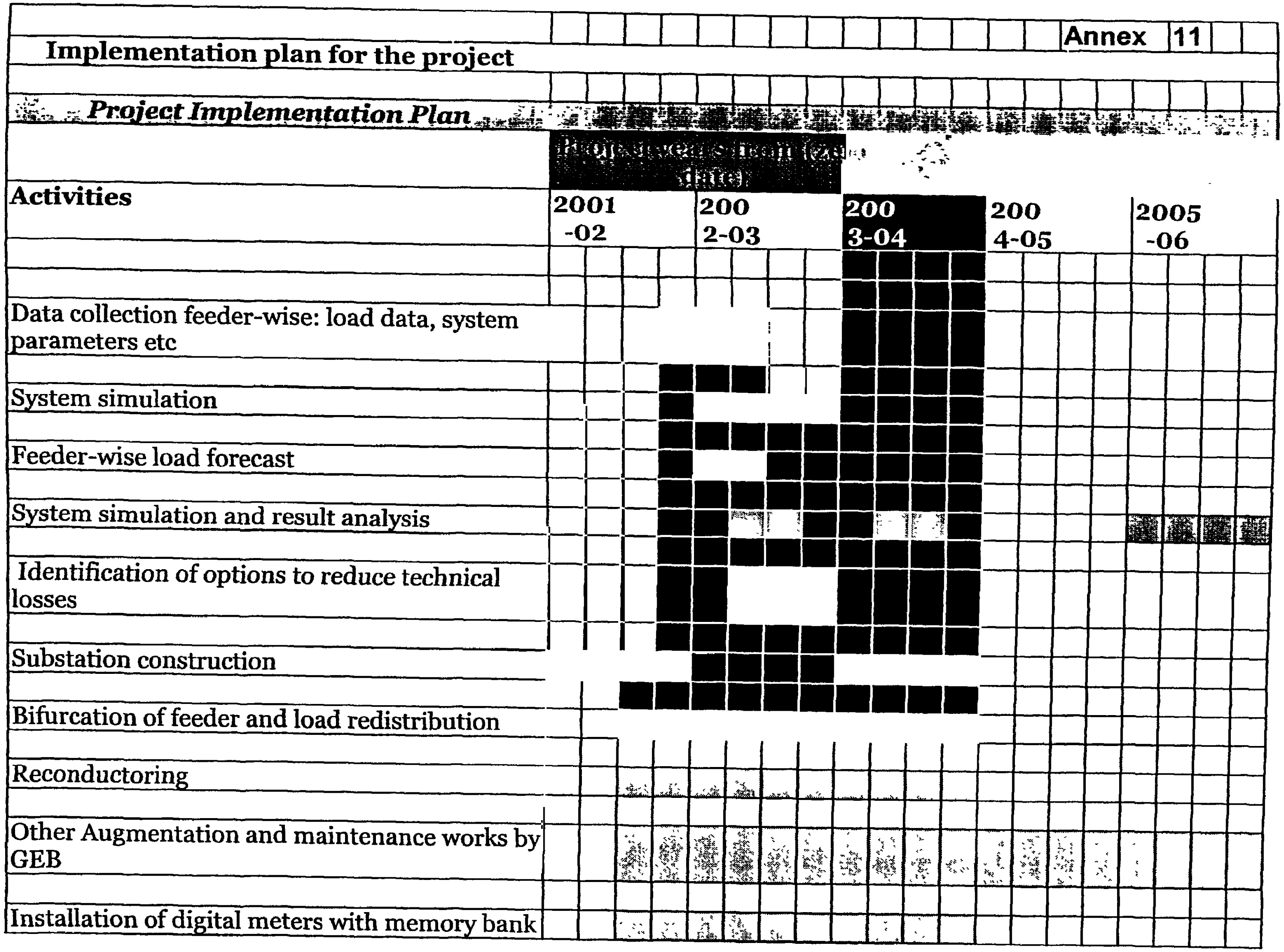
### Final Summary

| Year | 2000-01 | 2001-02 | 2002-03 | 2003-04 |
|---|---|---|---|---|
| Base Case | 41.3 | 49.8 | 56.8 | 63.5 |
| Alternate Case | 41 3 | 46.5 | 52 7 | 56.7 |
| Saving (MU) | 0 0 | 3.3 | 4 1 | 6.8 |
| Cost (Lakhs) | 0.0 | 433 0 | 15.5 | 422.9 |
| Saving due to avoided Generation (MU) | 0 | 0 | 18 | 53 |
| Net Saving (MU) | 0.0 | 3.3 | 21 8 | 59.8 |
| Saving in Generation (MU) | 0 | 3 | 22 | 62 |
| Emission Factor (Kg/Unit) | 0.291 | | | |
| Saving in Carbon (Tonnes) | 0 | 993.1 | 6538.7 | 17915.4 |
| Investments<br>(all cost are in Lakhs Rupee) | | | | |
| System Improvements | | 433 | 16 | 423 |
| Arial Bunched Conductor Cost | | | 48 | 48 |
| Installation of meters | | | 2277.3 | 2277.3 |
| Computer | | 5 | 0.6 | 0.6 |
| Training | | 8 | 8.8 | 9.7 |
| Managerial | | 24 | 26.4 | 29.0 |
| Vigilance | | 7.5 | 8.3 | 9.1 |
| Information | | 1.5 | 1.5 | 1.5 |
| **Cost Calculation** | | | | |
| Capital cost | 0 | 438.0 | 64.1 | 471.5 |
| O&M Cost | 0 | 52.6 | 60.3 | 116.8 |
| Cost for managerial activities | 0 | 41.0 | 2322.2 | 2326.6 |
| Other Cost (Software) | | 15 | | |
| Net Expenditure | 0 | 546.6 | 2446.6 | 2914.9 |
| Revenue realization (Total) | | | | 1049.1 |
| Revenue realization (40 % used in project) | | | | 419.7 |
| Revenue realization (balance for revolving fund) | | | | 629.5 |
| Total Carbon saved | 230658.7 | | | |
| NPV 1 (Investment) | 4962 | | | |
| NPV 2 (Revenue increase) | 6880 | | | |
| Cost of Carbon (Lakhs/Tonne) | -0.0083 | | | |
| Cost of Carbon Rs/Tonne | -831.7 | | | |
| Cost of Carbon US$/Tonne | -17 3 | | | |

Annex 11

## Implementation plan for the project

### *Project Implementation Plan*



Project years from (ze
date)

| Activities | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 |
|---|---|---|---|---|---|
| Data collection feeder-wise: load data, system parameters etc | | | | | |
| System simulation | | | | | |
| Feeder-wise load forecast | | | | | |
| System simulation and result analysis | | | | | |
| Identification of options to reduce technical losses | | | | | |
| Substation construction | | | | | |
| Bifurcation of feeder and load redistribution | | | | | |
| Reconductoring | | | | | |
| Other Augmentation and maintenance works by GEB | | | | | |
| Installation of digital meters with memory bank | | | | | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | |
| Computerized billing | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| Setting up of H R Cell and vigilance squad | | | | | ■ | ■ | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| Need Assessment | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| Designing of Training Programme | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| Imparting training | | | | | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | | |
| | | | | | | | | | | | | | | | | | | | | |
| Monitoring and Evaluation of training | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | | | | | | | | | | | | | | | | | | | | |
| Evaluation of project | | | | | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ |
| | | | | | | | | | | | | | | | | | | | | |
| Information dissemination | | | | | | | | | | | | | | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ | ▨ |

## Annex 10

| | 2005-06 | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | Total |
|---|---|---|---|---|---|---|---|
| | 73.0 | | | | | | |
| | 65.0 | | | | | | |
| | 7.9 | | | | | | |
| | 0.0 | | | | | | |
| 71 | 71 | | | | | | |
| | 78.6 | | | | | | |
| 80 | 81 | | | | | | |
| 7.8 | 23564.4 | 25920.84 | 28512.93 | 31364.22 | 34500.64 | 37950.71 | 230658.7 |
| 0 | 0 | | | | | | |
| 0 | 0 | | | | | | |
| .6 | 0.6 | | | | | | |
| .6 | 11.7 | | | | | | |
| .9 | 35.1 | | | | | | |
| .0 | 11.0 | | | | | | |
| .5 | 1.5 | | | | | | |
| .6 | 0.6 | | | | | | |
| .9 | 117.0 | 117.0 | 117.0 | 117.0 | 117.0 | 117.0 | 1048.404 |
| | 59.3 | | | | | | |
| .8 | 176.9 | 117.0 | 117.0 | 117.0 | 117.0 | 117.0 | 6841.435 |
| .4 | 4196.6 | 4196.6 | 4196.6 | 4196.6 | 4196.6 | 4196.6 | 29376.2 |
| .0 | 1678.6 | 1678.6 | 1678.6 | 1678.6 | 1678.6 | 1678.6 | 11750.5 |
| .5 | 2518.0 | 2518.0 | 2518.0 | 2518.0 | 2518.0 | 2518.0 | 17625.7 |